The One-Percent across Two Centuries:
A Replication of Thomas Piketty's Data on
the Distribution of Wealth for the United States

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Abstract

This exercise reproduces and assesses the historical time-series on the top shares of the wealth distribution for the United States presented by Thomas Piketty in *Capital in the Twenty-First Century*. Piketty's best-selling book has gained as much attention for its extensive presentation of detailed historical statistics on inequality as for its bold and provocative predictions about the continuing rise in inequality in the twenty-first century. Those predictions were derived and justified by reference to the historical data, so it is helpful to assess the robustness of the historical evidence presented. Here I examine only Piketty's U.S. data for the period 1810 to 2010 for the top ten percent and the top one percent of the wealth distribution. I conclude that Piketty's data for the wealth share of the top *ten percent* for the period 1870-1970 are unreliable. The values he reported are manufactured from the observations for the top *one percent* inflated by a constant 36 percentage points. Piketty's data for the top one percent of the distribution for the nineteenth century (1810-1910) are also unreliable. They are based on a single mid-century observation that provides no guidance about the antebellum trend and only very tenuous information about trends in inequality during the Gilded Age. The values Piketty reported for the twentieth-century (1910-2010) are based on more solid ground, but have the disadvantage of muting the marked rise of inequality during the Roaring Twenties and the decline associated with the Great Depression. The reversal of the decline in inequality during the 1960s and 1970s and subsequent sharp rise in the 1980s is hidden by a fifteen-year straight-line interpolation. This neglect of the shorter-run changes is unfortunate because it makes it difficult to discern the impact of policy changes (income and estate tax rates) and shifts in the structure and performance of the economy (depression, inflation, executive compensation) on changes in wealth inequality.

[312 words]

The reproducibility problem in science is a familiar issue, not only within the scientific community, but with the general public as well.
Stuart Buck
Editorial in *Science* [2015: 1403]

This is how science works. How else will we converge on the truth? Really, the surprising thing is that this kind of systematic attempt at replication is not more common.
Joshua Correll
Quoted by *Science* [Bohannon 2015: 910]

In social science history the Big Book of 2014 was surely Thomas Piketty's *Capital in the Twenty-First Century.*[1] It was big in bulk (685 pages) but more significantly it was big in its impact. Piketty's book is about the concentration of wealth and the dynamics of economic inequality. It relies on two centuries of historical data from twenty countries. The book has attracted a good deal of attention for its scope and breadth and also for its bold and startling predictions, the most disturbing is the following:

> It is almost inevitable that inherited wealth will dominate wealth amassed from a lifetime's labor by a wide margin, and the concentration of [wealth] will attain extremely high levels – levels potentially incompatible with the meritocratic values and principles of social justice fundamental to modern democratic societies. [Piketty 2014: 26]

By the time the English translation appeared in April of 2014, the distribution of wealth in the United States was already the object of public discussion and concern animated by the Occupy Wall Street encampments in Zuccotti Park, September through December of 2011. Those protests focused on the disparity between those in the top one percent of the wealth distribution and those in the bottom 99.[2] Coming at the right time, Piketty's book, with its frightening

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[1] Originally published in French, *Le Capital au XXIe siècle*, Éditions du Seuil, 2013. The English translation was by Arthur Goldhammer [Piketty 2014].

[2] Informed by an article written by Joseph Stiglitz for *Vanity Fair* which appeared in May 2011, the protestors claimed that the top 1 percent controlled 40 percent of the nation's wealth. Stiglitz's 2011 article in *Vanity Fair* does not include source references. Stiglitz's book, *The Price of Inequality*, cites Edward Wolff's analysis of the U.S. Survey of Consumer Finance [Stiglitz 2012: note 4, p. 377]. Wolff estimates the marketable wealth owned by the top one percent in 2007 at 34.6 percent of the national total, and the percent of wealth excluding the equity of the household's primary residence to be 42.7 percent of the national total [Wolff 2010: Table 2, p. 44]. Marketable wealth excludes consumer durables and the value of future defined-pension benefits from both private plans and Social Security. An alternative estimate of the marketable wealth owned by the top one percent of families based on

prediction, hit a nerve and injected new frisson into both the scholarly and the partisan debates.[3] Prominent economists were quick and effusive with their praise. Robert Solow called it a "new and powerful contribution" [22 April 2014]. Paul Krugman called the book "magnificent" [8 May 2014], "the most important economics book of the year – and maybe of the decade" [24 March 2014] and noteworthy because, unlike many trade books on economic issues, it constitutes "serious, discourse-changing scholarship" [24 April 2014]. Branko Milanovic writing in the *Journal of Economic Literature* described it as a "watershed book in economic thinking" [2014: 519].

Most commenters agreed that an unqualified strength of the book was its quantitative history. Alexander Field's review essay in the *Journal of Economic History* praised the book as "both an exemplary work in quantitative economic history and economic literature in the finest sense" [Field 2014: 916]. Krugman cited its "unmatched historical depth" [8 May 2014]. Lawrence Summers declared that "Even if none of Piketty's theories stands up, the establishment of [the historical facts] … is a Nobel Prize-worthy contribution" [2014]. Peter Lindert, writing for a French audience, claimed the book, with its "solid empirics," has "transported us to a higher understanding of historical movements in inequality" [Lindert 2015].[4]

Piketty covered a wide range of historical statistics. He documented the annual trends in the top income and wealth shares for the last two centuries. He estimated time series for the top ten percent and the top one percent of the two distributions. He reported data from the United States, France, the United Kingdom, Sweden, and Germany. The breadth of his coverage is

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the capitalized value of the income reported in federal tax returns set the percentage at 37 percent in 2007 and 41.8 percent in 2012 [Saez and Zucman 2015, online "Technical Appendix," Table B1].

[3] *Capital* has sold more than 1.5 million copies, more than enough to be a *New York Times* #1 Best Seller. It has garnered quite a few awards including three from the Association of American Publishers, the Hawkins Award, the Award for Excellence in Economics, and the Award for Excellence in Social Sciences.   It received seemingly everyone-in-the-media's nomination for the best book of 2014 including at Amazon.com, BBC News, Bloomberg News, Esquire, Financial Review, Financial Times, Foreign Affairs, Fortune, Google top search, Kirkus Reviews, Mother Jones, Publishers Weekly, New York Times, Wall Street Journal, Washington Post, and many others. Thomas Piketty, although a French citizen, rejected the nation's highest award, the *Legion D'Honneur*, commenting that he did not think the government should not "decide who is honorable."

[4] "L'ouvrage monumental de Thomas Piketty Le capital au XXIe siècle nous a permis de mieux comprendre les évolutions historiques des inégalités."

daunting. Here I narrow the focus. I report my efforts to replicate Piketty's estimates for the top one percent of the wealth distribution for the United States. As Piketty notes, the underlying American data appear to be less solid than that of the European countries, at least for the years before 1962, and is particularly shaky for the nineteenth century. Thus it seems that the American experience could claim a higher priority for reevaluation.

Piketty's estimates of American income inequality are limited to the twentieth century, but his wealth estimates begin in 1810. He and his commenters make much of the comparison of recent wealth estimates with those from the nineteenth century. Piketty referred repeatedly to the American Gilded Age as a period marked by extreme wealth inequality created and intensified by end-of-life bequests [Piketty 2014: 348-350, 375, 377-378, 506]. [5] "In all likelihood," he predicted, "inheritance will again play a significant role in the twenty-first century, comparable to its role in the [nineteenth century]" [p. 377]. Krugman titled his review "Why We're in a New Gilded Age" and suggested that the country was "on a path back to 'patrimonial capitalism,' in which the commanding heights of the economy are controlled not by talented individuals but by family dynasties" [8 May 2014]. Social science historians certainly have a stake in the question of whether we are in or headed into a "New Gilded Age." They also have something to say about wealth accumulation in the original Gilded Age.

Academics, journal editors, and the federal agencies funding scientific and social scientific research have recently become concerned about the problem of reproducibility. Reports on how frequently researchers in cell biology and social psychology (to name just two examples) failed to reproduce published results have become well known both within those fields and throughout the larger community [Buck 2015, Bohannon 2015]. And rightly so, the inability to reproduce key findings undermines the credibility of the scientific enterprise. *Science*, a publication of the American Association for the Advancement of Science and "the world's leading journal of original scientific research," convened a forum on the problem of

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[5] For American historians the period beginning with the end of the Civil War and ending sometime around 1917 (as dated by the first confiscatory income tax [Sutch 2015, Figure 2]) is known as the "Gilded Age." That enduring appellation was assigned at the outset of the period by Mark Twain in the novel co-written with Charles Dudley Warner, *The Gilded Age: A Tale of Today* [1873]. The authors were suggesting that they lived during a false "golden age," gilded on the surface but base and vulgar underneath.

reproducibility and issued a set of recommendations for promoting an open research culture [Nosek, Alter, *et al.* 2015]. A specific suggestion for scientific journals was to encourage and incentivize attempts to replicate significant findings. Piketty's "discourse-changing" effort certainly qualifies as significant.[6]

The panel also emphasized researchers' obligation to make their data and methodology transparent and open. On this score Thomas Piketty earns high marks. His practice is far better than usually encountered. He has made his data publically available and has documented his methodologies in a set of on-line technical appendixes, spreadsheets, and supplemental commentary. Had he not done so, this replication exercise would not have been possible. Yet the replication was not easy, Piketty's documentation was not always complete and the guidance was sometimes difficult to follow.

Estimates for the Twentieth Century, The Top One Percent

Piketty used two basic sources to estimate the distribution of wealth in the twentieth century and up to 2010 [Piketty 2014: 347]. One is the archive of estate tax returns filed with the Internal Revenue Service and analyzed by Wojciech Kopczuk and Emmanuel Saez [2004]. The estate tax was introduced in 1916 and, despite a number of changes in coverage and marginal rates, it has remained part of the tax code ever since [Lucky 2009]. These records provide information on the wealth at death of those with estates that exceed the exemption level. Kopczuk and Saez employed a technique known as the "estate multiplier" to covert the data on wealth of the deceased into an estimate of the percentage of wealth going to the top one-percent of the living population annually from 1916 through 1950, from 1982 through the year 2000, and for ten spate years between 1951 and 1981 [Kopczuk and Saez 2004: Table 3, 454-455]. Their method requires the age and sex of each decedent, information which is also recorded in the tax records. With this methodology each estate tax return is weighted by the inverse probability of death at that age. What this means is that the wealth of individuals who die young – a rare event

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[6] *Social Science History* encourages the submission of replication studies and conducts blind review of results. This policy conforms to the Level 2 recommendation under "Replication" advocated by Brian Nosek, George Alter, and 37 others [2015: 1424].

– is given a higher weight reflecting the fact that the tax records contain relatively fewer observations of wealth at those ages.[7]

Piketty's second source is the periodic Survey of Consumer Finance (SCF) conducted by the Flow of Funds unit of the Federal Reserve. These surveys include an over-sampling of the very rich and have been conducted irregularly in the years 1962, 1969, 1983, 1989, 1992, 1995, 1998, 2001, 2004, 2007, 2009, 2010, and 2013. The SCF has been analyzed in a series of studies by Edward Wolff who summarized his results in two recent articles [Wolff 2012, 2014]. The SCF data have also been independently used to produce estimates for the top one percent for the years spanning 1989 through 2009 by Flow of Funds staff researchers [Kennickell 2009, 2012; Bricker *et al.* 2011].

Both data sets are imperfect as a measure of the concentration of wealth [Kopczuk 2014], but one important point to note is the estate tax returns reflect the wealth of *individuals* while the SCF covers *spending units*, which are defined to include all individuals living in a household and assumes that they pool their resources. The relationship between the two measures can be seen in the **Figure 1**. The dashed line for the period 1916 to 2000 is the measure estimated for individuals from the estate data [Kopczuk and Saez 2004: Table 3, column 2, pp. 454-455]. The observations indicated by the dots are those reported by Wolff for 1962,

Figure 1. Percent of Wealth Owned by the Top One Percent

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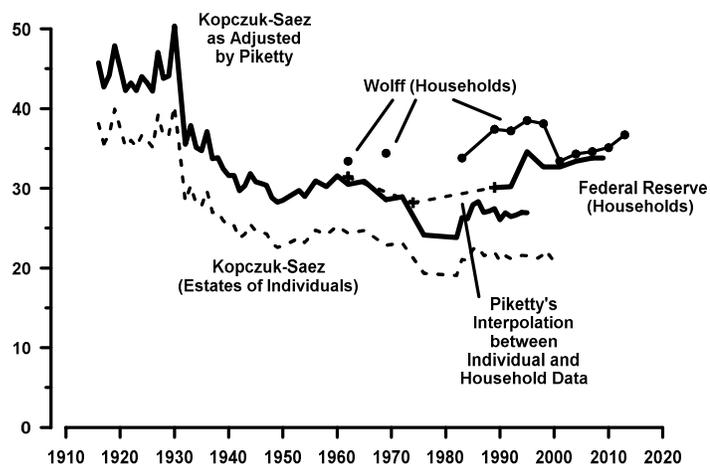
[7] The pioneers in using U.S. estate tax data were Horst Mendershausen [1956] and Robert Lampman (1962). The procedure assumes that the wealthy experience the same mortality at each age as those in the general population. In modern data, it should be noted, it has been shown that wealth and the hazard of mortality are negatively correlated [Attanasio and Hoynes 2000, Waldron 2007]. Presumably wealth can be spent in ways that improve health (better sanitation, better diet, greater access to medical intervention). As a consequence, the rich live longer. However this relationship may be prominent only in data from the last decades of the twentieth century. The relative improvements in life expectancy for the wealthy seem to be related to their propensity to refrain from smoking and the advantages conferred by college education [Mears, Richards, and Cutler 2008].

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1969, and 1983-2013 for households [Wolff 2012: Table 2, 50; 2014: Table 2, 50]. The alternative SCF series reported by the Federal Reserve is plotted with the solid line for 1989 through 2009 [Kennickell 2009: Table 4, 35; 2012: Table 5, 12 footnote].

Piketty gives the impression that the difference between the two measures is explained by the fact that a household measure "always leads to higher inequality than if it was measured [for individuals]" [Piketty 2014b: 56]. Actually, the difference between the two measures is ambiguous, the size and sign of the gap depends upon the distribution of wealth within the family [Kopczuk and Saez 2004: 476]. If the entire gap between the two measures in Figure 1 is attributable to the distinction between individual and family measures, it would imply that many wealthy families at the end of the twentieth century split their wealth between husband and wife. Kopczuk and Saez offer a list of other potential explanations for the divergence between their estate tax estimates and the SCF. The estate tax data may be flawed because of tax avoidance and significant under evaluation of taxable assets. Another uncertainty arises with the possibility that inaccurate assumptions about age-specific mortality and marital and charitable bequests distort the estate tax estimates. The SCF includes the human capital of a business owner that would disappear at death causing the value of closely-held businesses to drop when the owner-manager dies [Kopczuk and Saez 2004: 478-479].

The raw numbers presented in Figure 1 were the "bedrock" employed by Piketty to produce the chart he published as Figure 10.5 and which I reproduce here as **Figure 2** [Piketty 2014a: 348, 2014b: 1].[8] To arrive at the smooth version he presented, Piketty made several adjustments to the data. First he reconciled the differences between the estate data and the survey data. Since he felt that the SCF data is more reliable than the estate data he chose to adjust the Kopczuk-Saez series upward to link with the SCF data and then to switch from the adjusted estate data to the SCF data at the earliest possible date, 1962. Kopczuk and Saez warn in this context that "patching together data from different sources is a perilous exercise" [2004: 479]. However, characteristic of his bold approach to the topic, Piketty did exactly that in a process he described as "homogenization" [Piketty, "Technical Appendix," 2014b: 56-58]. For the years 1930 through 1959 he inflated the estimates of Kopczuk-Saez by a factor of 1.25 to obtain an

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[8] The source for Figure 2 is Piketty's Figure 10.5 [2014: 348] modified to remove the line for the top ten percent.

estimate comparable to the SCF series. For the years 1916 through 1929 he used the multiplier 1.2. That procedure produced the solid line in Figure 1. For the illustrative purposes of Figure 1 I have continued to use the 1.25 multiplier to inflate the estate data from 1960 through 1995.

The first available data point based on an SCF survey is for 1962. As reported by Wolff the top one percent of the wealth distribution held 33.4 percent of total wealth that year [Wolff 1994: Table 4, 153; and Wolff 2014: Table 2, 50]. Without explanation Piketty adjusted this *downward* to 31.4 by subtracting 2 percentage points. Piketty's adjusted number is represented by the cross plotted for 1962 in Figure 1. Chris Giles, a reporter for the *Financial Times*, described this procedure as "seemingly arbitrary" [Giles 2014].[9] In a follow-up response to Giles, Piketty failed to explain this adjustment [Piketty 2014c "Addendum"].

There is a bit of a mystery as to where the 1.2 and 1.25 multipliers used to adjust the Kopczuk-Saez estimates upward came from. The spreadsheet that generated the data (TS10.1DetailsUS) suggests that Piketty was influenced in this choice by the inflation factor that would be required to bring the solid line up to reach his *adjusted* SCF estimate for 1962. Piketty did not explain why the adjustment multiplier jumps from 1.2 to 1.25 in 1930.

Because there were no SCF surveys taken in the 1970s, Piketty simply inserted an arbitrary value for 1974 designed to lie close to his solid line in Figure 1. That number, 28.2 percent, is marked with a second cross.[10] He then interpolated a straight line across the fifteen years between that value for 1974 and the Federal Reserve's observation for 1989 – not Wolff's

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[9] Phillip Magness and Robert P. Murphy, who independently called attention to these problems, characterized Piketty's Figure 10.5 "a Frankenstein graph, assembled from bits and pieces of the secondary literature" [2015].

[10] Piketty's spreadsheet indicates that the value of 28.2 was generated by a baffling, arbitrary, and totally unnecessary manipulation. He first calculated the decline between the Kopczuk-Saez average for the 1960s and their average for the 1970's. But the series he used was the Kopczuk-Saez estimates of the wealth share owned by the top 0.1 percent, *not* the top one-percent, of individuals. Piketty then applied that proportional decline to reduce the SCF wealth share of the top one percent for 1962 as represented by the Piketty-adjusted estimate reported by Wolff to obtain a value of 26.2. Piketty then *added* 2 percent to that number to get 28.2. There is simply no justification for such a round-about procedure. If 28.2 was the number he wanted for 1974, Piketty might have calculated the decline of the wealth share for the top one percent and then used that to further adjust the adjusted Wolff estimate for 1962 and then add 0.75 percent. The bottom line is that there is no reason to believe that had an SCF survey been taken in 1974 that it would have revealed a share for the top one percent of 28.2 percent.

[Kennickell 2009: Table 4, p. 35]. He then followed the Federal Reserve's data through 2009.[11] This combination of homogenization and interpolation is not only perilous but it hides the continuing decline in concentration between 1972 and 1982 reported by Kopczuk and Saez for individuals (a decline of 16.5 percent) and then neglects to report the rapid rebound that took place between 1982, when the estate data recorded its lowest point, and the late 1980s (a 17.3 percent increase). I suspect that the measured increase in wealth owned by the top one percent after 1982 reflects both the increase in the stock market and the sharp reduction in the marginal rates of income taxation for the wealthy introduced by the Reagan administration. The federal government slashed the top marginal tax rate in a series of steps from 70 percent in 1981 to 28 percent in 1988 [Carter *et al.* 2006: Series Ea826].[12] If an objective of charting trends in the concentration of wealth is to lay a foundation for thinking about the dynamics of wealth inequality, then measuring and analyzing the trend reversal in top wealth shares in the 1980s is worthy of close attention.

A recent contribution by Emmanuel Saez and Grabriel Zucman provides a confirmation of the Reagan-era increase in the concentration of wealth for the top one percent of households. **Figure 3** presents Piketty's estimates plotted with a solid line. The linear interpolation between 1974 and 1989 is shown as a dashed line. The other time series in the figure traces

Figure 3. Percent of Wealth Owned by the Top One Percent

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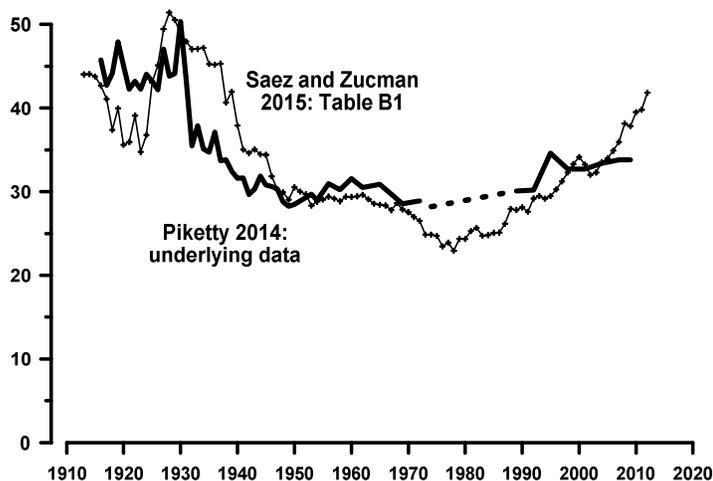
[11] Piketty did not explain why he preferred the Federal Reserve's series to Wolff's. As Figure 1 indicates, the difference between the two SCF-based series is significant for the years 1962-1998 and for that reason, I would suggest, deserved comment. But given the arbitrary adjustment to the SCF-Wolff estimate for 1962 and the gratuitous insertion of a number for 1974 when no SCF survey was taken, it is fair to say that Wolff's data had no influence on Piketty's time trend for the top one percent.

[12] Estate and gift tax rates were also lowered significantly in this period [Lucky 2003: 11-21, Kopczuk and Saez 2004: Figure 10, 474]. Stock market averages can be found in Carter *et al.* [2006: Table Cj].

out the new estimates made by Saez and Zucman by capitalizing asset income flows reported by income tax returns [2015: Table B1]. Those alternative estimates were not available to Piketty at the time he prepared his book.

The final step in Piketty's effort to chart the twentieth century trend for the top one percent's share of wealth was to smooth the raw data by plotting only decadal averages. The value plotted for 1920, for example, is the average of the adjusted Kopczuk-Saez data for the 1920s.[13] This technique averages out the dramatic spike in the share of wealth owned by the top one percent that occurred during the last half of the 1920s and reached an all-time high in 1930 of over 50 percent.[14] Some of this rise in inequality can be explained by the fact that the markets placed a high value on the financial holdings of the rich before the Great Stock Market Crash of 1929-1933. But this was also a period in which the tax rates on the rich were dramatically lowered. The average tax rate on a taxable income of $1 million fell from 66.3 percent in 1921 to 43 percent in 1924 and then again to 24.1 percent in 1925 [Carter *et al.* 2006: Series Ea772]. While some smoothing maybe justifiable, smoothing over an entire decade makes it difficult to connect public policy changes, stock market swings, and other developments to changes in the distribution of income and wealth.

Estimates for the Nineteenth Century, The Top One Percent

Piketty admits, in the *Technical Appendix* to his book, that "huge uncertainties exist on [his nineteenth century] estimates" [Piketty 2014b: 58]. For the United States in the mid-nineteenth century Piketty has only one real data point, an estimate for 1870 of 32 percent (Figure 2).   This is the proportion of the national wealth held by the top one percent based on the census of wealth conducted at the time of the 1870 Census of Population [U.S. Census Office 1870].   Piketty cites the source for the 1870 observation as Lee Soltow [1975: Table 4.2, 99] as reported by Peter

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[13] For the record it is noted that only the decades for the1920s, 1930s, and the 1940s, have an observation for all ten years. The data for 1910 is the average for 1916-1919. The decades of the 1960s, 1980s, and 2010s are represented by a single observation each, for 1962, 1989, and 2007. Incidentally, the spreadsheet provided by Piketty indicates that the figure for 1989 should have been calculated as an average of Wolff's figure for 1983, 33.8, and Kinnickell's figure for 1989, but the data plotted is actually based on the 1989 data alone, 30.1.

[14] The fact that Piketty's adjustment multiplier changed from 1.2 to 1.25 between 1929 and 1930 probably exaggerates the peak in 1930.

Lindert [2000: Table 3, 188]. Soltow's findings were based on an idiosyncratic "spin sample" drawn from the physical microfilms of the census enumerations. Soltow marked a spot on the glass screen of the microfilm reader, turned the crank a half turn, and sampled the individual whose name fell on the marked spot provided it identified a male 20 years old or older. He proceeded in this fashion through all 1,761 rolls of microfilm for the 1870 census [Soltow 1975: 4-5]!

Soltow's estimate of the total assets (the sum of personal assets and real estate) held by the top one percent of adult men in 1870 is 27 percent.[15] Piketty inflated Soltow's value to 32 percent presumably to convert total assets owned by the top *individuals* to net worth owned by the top *households*. Piketty offered no discussion of how he came by the adjustment. My guess is that he simply multiplied the 27 by 1.2, which is the same multiplier he used to make such a conversion on the estate-derived data for 1916-1929. That multiplier, however, was rather tenuously based on the comparison of Kopczuk and Saez's estimates for individuals in 1962 with Wolff's estimate for households that year notwithstanding the 98-year separation between the two dates, the different nature of the two sources (census reports versus estate tax returns), and the arbitrary reduction of the original 1.25 multiplier when applied to years before 1930.

If we take the value of 32 percent for 1870 at face value, it implies that the share of wealth owned by the top one percent of households increased by one quarter to reach a wealth share of 45.1 percent in 1910. That, I think, must be considered very uncertain. It is unclear to me if the finding should be regarded as support for the commonly-assumed increase in the concentration of wealth over the course of the Gilded Age [Steckel and Moehling 2001, DeLong 2003: 48-49, Lindert 2006: Figure Be-B, 624, Carter *et al.* 2006: Series Be40 and Be49] or whether the manipulations performed on Soltow's numbers were intended to illustrate that consensus.[16]

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[15] Piketty suggests that he took the average of Soltow's estimates for 1860 (free adult males) with 1870 (all adult males) [2014b "Technical Appendix," Supplemental Table S10.1]. That number is 28 percent.

[16] An increasing concentration of wealth during the Gilded Age was also reported by those contemporaries who considered the issue carefully [Holmes 1893, King 1915: 84, Fisher 1919: 11].

Piketty also plotted a point in his Figure 10.5 for 1810 (see Figure 2). It is 25 percent suggesting that there was also an increasing concentration of wealth between 1810 and 1870. Piketty cited "Shamas (sic) 1993 and Lindert 2000" as his sources [Piketty spreadsheet TS10.1, also see Piketty and Zucman 2014: 17]. But neither Carole Shammas nor Lindert give a figure for 1810 [Shammas 1993, Lindert 2000]. Here is my best guess. Piketty started with Alice Hanson Jones' estimate for 1774 for all households, 16.5, which is found in Lindert [2000: Table 3, 188].[17] Piketty then rounded that off to 17. He then turned his attention to the 1860 free adult males figure for total assets in Lindert (referencing Soltow again). To obtain an estimate for net worth of a household he applied the ubiquitous 1.2 adjustment multiplier. He then read a figure for 1810 off a straight-line interpolation between 1774 and 1860. Following that procedure I get 24.5, which Piketty rounded to 25.

I can appreciate Piketty's desire to have a wealth distribution estimate for 1810, but I find his simple interpolation difficult to accept. Between 1774 and 1810 there was the Revolutionary War which saw the departure of many wealthy United Empire Loyalists and a post-war period of mercantile and shipping prosperity during which some large fortunes were amassed in Philadelphia, Baltimore, New York, and Boston. Jefferson's Embargo of 1807 and the recession in 1809 hit these fortunes especially hard. I find it difficult to credit a straight-line interpolation through this turbulent period. Piketty has provided very little information about what changes occurred in the distribution of wealth during the antebellum period. Jeffery Williamson and Peter Lindert, however, suggested a "working hypothesis" 35 years ago after reviewing the evidence. "Wealth concentration rose over most of the period 1774-1860, with especially step increases from the 1820s to the late 1840s" [Williamson and Lindert 1980: 46]. That hypothesis has held up according to more recent studies [Lindert 2000: 190, Steckel and Moehling 2001].

Assessment of Piketty's Estimates for the Top One Percent

The heavily manipulated data, the lack of clarity about the procedures used to harmonize and average the data, the insufficient documentation, and the spreadsheet errors are more than annoying. Very little of value can be salvaged from Piketty's treatment of data from the

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[17] Jones's estimate for 1774 employs the estate multiplier method to a sample of 919 probate inventories [1980: Table 1, xxiv]. Shammas recalculated the fraction of wealth owned by the top one percent to be 18 percent [1993, Appendix A].

nineteenth century. The user is provided with no reliable information on the antebellum trends in the wealth share and is even left uncertain about the trend for the top one percent during the Gilded Age (1870-1917).

The long-run trend Piketty documents for the period 1918 to the 1960s is believable. Figure 3 plots Piketty's data based on estate taxation and data subsequently available based on taxable income flows. The two series are in rough agreement. The roaring twenties saw an increase in inequality, the Great Depression and the New Deal produced a reversal. The post-war era through the mid-1960s, both series agree, was one of relative stability with the top one percent holding about 30 percent of the nation's wealth. Unfortunately, the decadal averaging that Piketty used to smooth the series for publication obscures both the sharp increase in inequality in the late 1920s and the move towards more equality in the 1930s and 1940s.

Given the more abundant and presumably more reliable underlying raw data for the decades since the mid-1960s, it surprised me that the trends presented by Piketty appear to be untrustworthy. Two deficiencies stand out. Piketty's linear interpolation over the 1970s and 1980s, evident in Figure 3, obscures, first, declining inequality in the late 1960s and 1970s and then the sharp rise in concentration during the Reagan-Bush era. Second, the underlying data for the 1990s and the first decade of the twenty-first century reveals a sharp disagreement regarding the wealth share for the top one percent and its trend. The Federal Reserve data, which Piketty preferred, shows a modest increase between 1990 and 2010 while the alternative series by Edward Wolff, plotted in Figure 1, shows a modest decline from 1995 through 2001 followed by an increase from 33.4 to 36.7 in 2013. Piketty made no effort to reconcile the divergence. I also illustrate in Figure 3 that the recently released Saez and Zucman household data based on income tax returns disagrees with both of Piketty's sources for the last decade. That new series has the top one percent wealth share increasing steadily ever since the mid-1960s and reaching 41.8 percent by 2012.

The Wealth Share of the Top Ten Percent

When examining Piketty's data for the trend of the top ten percent of the distribution it is difficult to be forgiving. The first point to make is that Piketty apparently thinks that his trend for the top 10 percent is more reliable than his trend for the top one percent. At least in the issue

of *Science* for May 23, 2014 he has a coauthored review with Emmanuel Saez which presents his data for the top ten percent but does not present the companion series for the top one percent [Piketty and Saez 2014: Figure 2, 839].[18]   I replicate the figure from *Science* here as **Figure 4**. It reproduced the data in Figure 10.6

Figure 4. Wealth Inequality in the United States, 1870-2010

Percent

Top 10% wealth share
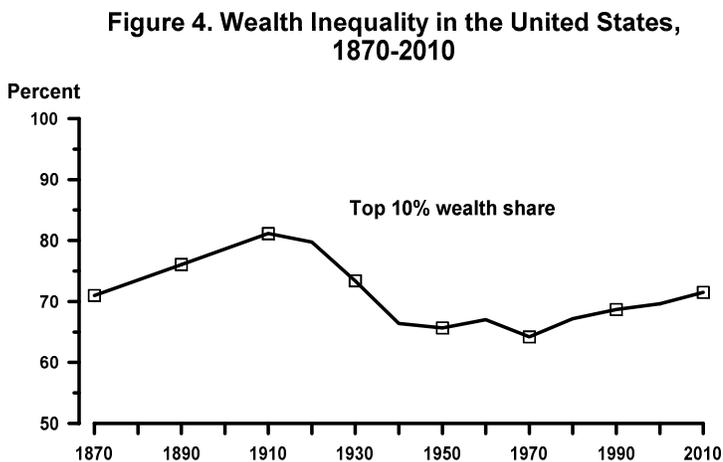
from Piketty's book except it drops the point for 1810, but it now inexplicably adds a point for 1890 that isn't in the book's version. The point plotted appears to be a simple linear interpolation between 1870 and 1910.

For 1870 Piketty reports Soltow's number taken from Lindert, 71 percent, but without applying the 1.2 multiplier that he used on the top one-percent wealth share, which consistency suggests he should have done.[19]   Had he done so, his 1870 figure would be 85.2 percent of the wealth in the hands of the top 10 percent. But that figure implies there was a fall in the wealth share between 1870 and 1910. So much for the "well-established fact that wealth in the United States became increasingly concentrated over the course of the nineteenth century" [Piketty 2014: 347].

As noted by Chris Giles all the top ten percent data for 1910 through 1950 and for 1970 was obtained by simply adding 36 points to the data for the top 1 percent wealth share. The data point for 1960 added 35.6 points without explanation, but strangely the 35.6-point adjustment is expressed as $33.6 + 2$.[20]   The 36-point adjustment is not explained. The constancy of this markup

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[18] Emmanuel Saez collaborated with Wojciech Kopczuk in preparing the twentieth-century time series on the U.S. distribution of wealth that Piketty relied upon to make his own estimates [Kopczuk and Saez 2004].

[19] Piketty suggested that he averaged Soltow's estimates for 1860 (free adult males) with 1870 (all adult males), 73 and 70 percent respectively.

[20] The resulting estimate for the top ten percent wealth share in 1960 is 67 percent which is precisely Wolff's estimate for 1962.

is questionable. The gap between the top ten percent and the top one percent wealth shares reported for 1870 by Soltow was 43 percentage points, not 36 [Soltow 1985: Table 4.2, 99].

For 1980 Piketty reported that he averaged the 1983 figure from Wolff [1994] with the 1989 Federal Reserve figure from Kennickell [2009]. Had he done that, the number would be 67.7, but he reported 67.2 (which is the 1989 figure unaveraged). For 1990 Piketty's spreadsheet noted that he averaged three figures from "Kennickell 2001 Table 4" for the years 1992, 1995, and 1998 [TS10.1DetailsUS]. But actually he used Kennickell [2009: Table 4, 35] [Piketty 2014b: 57]. The averaging procedure should have given him 67.8, but he reported 68.7, probably a typo. For 2000 he claimed that he averaged Kennickell's values for 2001 and 2004. He again misreports the source as "Kennickell 2001" when he actually used Kennickell [2009]. For 2010 he claimed to be using an average of 2007 and 2009, but he reported the only the number for 2007 because he had no data for 2009 [Brickel *et al.* 2011].

The caption to the figure in *Science* says that the numbers are constructed from inheritance tax records, but that is only true for the data 1910-1950. This cavalier handling of the data and his sources on the top ten percent, may not be a fatal flaw but it is certainly unfortunate. It raises doubts about the care that Piketty has taken with his evidence. It gives partisan critics an excuse to ignore his concerns and policy proposals.

Conclusion

Capital in the Twenty-First Century with its impressive battery of historical statistics and its bold narrative framework has stimulated an outpouring of new and ongoing work, both interpretive and quantitative. That alone is a welcome development. I have a great deal of respect for Piketty's accomplishment and I do not question his integrity. Creating historical time series takes ingenuity, hard work, and an artist's touch. Thomas Piketty and his collaborators have done a great service for social scientists and historians by assembling and organizing dozens of time series relevant to the study of economic inequality. Their statistics stretch back at least two centuries. They include data for the United States and a number of European countries. They have quantified the distribution of income, the distribution of marketable wealth, and more. (Note, however, that this review is concerned only with the distribution of wealth in the United States.)

In a classic essay the British historian Herbert Butterfield argued that the "truth of history is no simple matter, all packed and parcelled ready for handling in the market-place" [Butterfield 1931: 132]. There is, then, a danger lurking here. Economists, perhaps more so than historians, are apt to take historical statistics as given, "all packed up and parceled" ready for interpretation and analysis. They forget that the ingenuity and the artistry that created the spreadsheet of numbers also produces an idiosyncratic picture of the past.

Piketty's manipulation and smoothing of the underlying data was designed to dramatize long-run trends without bogging his narrative down with the short-run details of economic history. Piketty referred to the trends in inequality smoothed over the last two centuries to support a dynamic model of wealth accumulation and inheritance that he then extrapolated to the future to warn that "the concentration of [wealth] will attain extremely high levels." This article is limited to examining the underlying data and to criticizing the methodology Piketty used to produce estimates of the long-run trends. As far as the American data on wealth is concerned, I found much to criticize. A quick summary of my findings is provided by the abstract. Whether the problems discovered will require Piketty to revise his analysis of the dynamics of wealth accumulation and intergenerational transmission, only he can say.

Social science historians with interests other than Piketty's, however, should not employ his numbers uncritically. In particular Piketty's time trends will prove misleading on such issues as the antebellum trend of inequality in the United States, the precise gyrations buffeting the Gilded Age economy, the redistributive impact of President Wilson's progressive income tax, the impact of the Roaring Twenties and Great Crash on wealth accumulation, or the impact of the Reagan-era tax cuts. Researchers interested in these questions should go behind and beneath the graphs in Piketty's book, examine the raw data for themselves, and revise the statistics as necessary to suit their own purpose. That effort, which must begin with replication, but hopefully will conclude with a better understanding, will take ingenuity, hard work, and an artist's touch. As Butterfield warned, "the understanding of the past is not so easy as it is sometimes made to appear." But, that is how science works.

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